What is claimed is

1. A method of depositing a ferroelectric thin film comprising:

preparing a substrate;

depositing an indium oxide film on the substrate; and

depositing a ferroelectric material on the indium oxide thin film using MOCVD.

2. The method of claim 1, wherein preparing the substrate comprises forming a silicon oxide layer overlying the substrate.

3. The method of claim 2, wherein the silicon oxide layer is formed by a CVD process, or a thermal oxidation process.

4. The method of claim 2, wherein the silicon oxide layer is between about 1nm and 10nm thick.

5. The method of claim 1, wherein the substrate is a silicon substrate, and preparing the silicon substrate comprises dipping the silicon substrate in buffered HF.

6. The method of claim 1, wherein preparing the substrate comprises forming a high-k layer overlying the substrate by depositing a high-k material selected from the group consisting of hafnium oxide, zirconium oxide, aluminum oxide, and lanthanum oxide.

7. The method of claim 1, wherein depositing an indium oxide film comprises placing the silicon substrate in a DC sputtering chamber with an indium target; providing a chamber pressure of between 1 torr and 10 torr at a deposition temperature of between about 20 °C and 300 °C; establishing a substrate temperature of between about 20 °C and about 300 °C; and sputtering the indium target using a DC sputtering power of between about 100 watts and about 300 watts with a backward power of less than 5% at an oxygen partial pressure of between 0 and about 60%.

8. The method of claim 6, further comprising annealing the indium oxide film at a temperature between about 400 °C and about 800 °C for between about 5 minutes and about 60 minutes in an oxygen atmosphere.

9. The method of claim 1, wherein depositing a ferroelectric material comprises preparing a liquid PGO precursor and injecting the PGO precursor into a vaporizer attached to an MOCVD chamber containing the substrate to form a precursor gas and depositing PGO overlying the indium oxide thin film.

10. The method of claim 9, wherein preparing the liquid PGO precursor comprises dissolving $Pb(thd)_2$ and $Ge(ETO)_4$ at a molar ratio of between approximately 5:3 and 5.5:3 in a mixed solvent of butly ether, or tetrahydrofuran, isoproponal and tetraglymer in a molar ratio of between approximately 6-9:1-3:1-2 to produce a precursor solution with a concentration of between about 0.05 M/L of PGO and 0.5 M/L of PGO.

11. The method of claim 10, wherein injecting the PGO precursor into the vaporizer comprises injecting the PGO precursor through a feed line maintained at between about 185 °C and 245 °C at a rate of between about 0.05 and 0.5 ml/min while maintaining the vaporizer at a temperature between about 180 °C and 240 °C.

12. The method of claim 11, further comprising annealing the ferroelectric thin film at a temperature between about 520 °C and 560 °C for between about 30 minutes and 60 minutes.

13. A method of depositing a PGO thin film comprising:

preparing a substrate with an upper surface of silicon, silicon oxide, hafnium oxide, zirconium oxide, aluminum oxide, or lanthanum oxide;

depositing an indium oxide film by placing the substrate in a DC sputtering chamber with an indium target; providing a chamber pressure of between 1 torr and 10 torr at a deposition temperature of between about 20 °C and 300 °C; establishing a substrate temperature of between about 20 °C and about 300 °C; and sputtering the indium target using a DC sputtering power of between about 100 watts and about 300 watts with a backward power of less than 5% at an oxygen partial pressure of between 0% and about 60%;

annealing the indium oxide film for between about 5 minutes and 60 minutes at a temperature of between about 400 °C and 800 °C in an approximately 20% to 100% oxygen atmosphere;

depositing a PGO film over the indium oxide film by placing the substrate in an MOCVD chamber at a temperature of between approximately 400 °C and 540 °C and a pressure between approximately 1 torr and 5 torr with an oxygen partial pressure of between approximately 20% and 30%, and introducing a vaporized PGO precursor into the MOCVD chamber; and

annealing the PGO film at a temperature between approximately 520 °C and 560 °C for between about 30 minutes and 60 minutes in an oxygen atmosphere.

14. The method of claim 13, wherein depositing the indium oxide film is accomplished by placing the substrate in a DC sputtering chamber with an indium target; providing a chamber pressure of between 1 torr and 10 torr at a deposition temperature of between about 20 °C and 300 °C; establishing a substrate temperature of between about 150 °C and about 200 °C; and sputtering the indium target using a DC sputtering power of about 150 watts with a backward power of less than 5% at an oxygen partial pressure of about 30%.

15. The method of claim 14, wherein annealing the indium oxide film takes place at a temperature of between about 500 °C and 600 °C.

16. The method of claim 15, wherein depositing a PGO film over the indium oxide film is accomplished by placing the substrate in an MOCVD chamber at a temperature of between approximately 500 °C and 510 °C and a pressure between approximately 2 torr and 5 torr.

17. The method of claim 16, wherein introducing the vaporized PGO precursor into the MOCVD chamber further comprises introducing a PGO precursor solution into a vaporizer at

a vaporizer temperature of between about 200 °C and 205 °C at a solution delivery rate of between about 0.1 ml/min and 0.2 ml/min.

18. The method of claim 17, wherein the PGO precursor solution comprises $Pb(thd)_2$ and $Ge(ETO)_4$ at a molar ratio of between approximately 5:3 and 5.5:3 in a mixed solvent of butly ether, or tetrahydrofuran, isoproponal and tetraglymer in a molar ratio of approximately 8:2:1 to produce a precursor solution with a concentration of about 0.1 M/L of PGO.

19. The method of claim 17, further comprising annealing the PGO film at a temperature of about 540 °C for approximately 30 minutes in an oxygen atmosphere following deposition of the PGO film.